

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Appl No. : 10/517,864 Confirmation No. 9009
Applicant : **Manfred RÄTZSCH et al.**
Filed : September 8, 2005
Title : Aminoplast Molding Compounds for Products Exhibiting an Improved Flexibility and Aminoplast Products Exhibiting an Improved Flexibility

TC/A.U. : 1796
Examiner : Liam J. Heincer

Docket No. : 4385-045796
Customer No. : 28289

Declaration of Dr. Manfred Rätzsch under 37 C.F.R. § 1.132

Mail Stop AF
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Commissioner:

I, **Manfred Rätzsch**, hereby declare that:

1. I am a named inventor of the invention disclosed and claimed in the subject patent application, U.S. Patent Application Serial No. 10/517,864.
2. I received the degree of Dr rer. nat in Physical Chemistry in 1958 at the University Leipzig (Germany), the degree of Dr habil. and the professorship in Polymer Technology at the University of Halle-Merseburg (Germany) in 1963.
3. I have been the head and president of research of the Polymer Dept. of the chemical company "Leuna Werke" (Germany) with 3000 employees for 15 years. In 1979 I was appointed as a director of the "Institute of Polymer Technology" of the Academy of Science in

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Dresden (Germany). In 1989 I started as a Vice president of R&D at the PCD (Austria). At that time I was appointed as an associated Prof. at the Universities of Leoben (Austria) and Linz (Austria). In 2000 the R&D group was taken over by the Borealis Company. Since 2001 I have been working as a consultant with AMI-Agrolinz Melamine International GmbH. I am the author and coauthor of 172 scientific publications, and more than 160 patents.

4. My working fields include the synthesis, characterization and application of condensation polymers, mainly based on melamine und urea formaldehyde resin. Additionally I am involved in the development of new aminoplasts with improved characteristics. I consider myself an expert in these areas.

5. I am familiar with the reasons for rejection of claims 22-24, 32-34 and 38 under 35 U.S.C. §103(a) as being unpatentable over U.S. Patent No. 5,206,066 ("Horacek") in view of U.S. Patent No. 4,081,426 ("Michel et al."), as well as the other §103(a) rejections based upon the Horacek reference set forth in the Office Action dated July 16, 2008 for the above-identified patent application.

4. I am familiar with the patent US 5,206,066 (Horacek).

Horacek teaches a melamine resin comprising a) partly etherified melamine resin obtainable by reaction of melamine, formaldehyde and C₁-C₈-alkanols in a molar ratio of melamine:formaldehyde:alkanol of 1: (5 to 6): (4 to 6), and b) diols consisting of polyester-diols and/or polyether diols having a molecular weight of at least 400 g/mol and low molecular weight C₂-C₁₂ diols.

The excess of formaldehyde provides for a highly substituted melamine, e.g., the amino groups of the melamine nuclei can be substituted up to 6 times with formaldehyde forming methylol groups, which are partly etherified with a C₁-C₈ alkanol.

The etherified melamine resin is mixed with the high and low molecular weight diols (optionally in the presence of an acid as catalyst) and stirred at 60°C until a modified melamine resin having a viscosity of 3000 mPas (3 Pas) is obtained (see Example 1).

Under these reaction conditions only a simple mixing of the diol with the etherified resin is achieved, but **not** a re-etherification of the partly etherified melamine resin with diol. This is due to the fact that the process of re-etherification is an equilibrium reaction. Thus, in order to progress with the reaction at least one of the formed reaction products has to be removed from the reaction mixture. In case of re-etherification this could be done by evaporating the released C₁-C₈-alkanol. However, at 60°C – as taught by Horacek- not even methanol as the lowest alkanol evaporates with a reasonable velocity. Thus, the reaction does not progress after reaching equilibrium and a re-etherification with a diol simply cannot occur.

The increase of molecular weight according to Horacek is only due to a simple bridging of the melamine nuclei via methylene- or methylenoxy bridges but **not** via long diol-oxy-bridges as in the present amino resins. This fact is also supported by the low viscosity of the resin since only the incorporation of long flexible bridges is able to provide for resins with a high viscosity and thus thermoplastic properties.

Furthermore, in my point of view and experience the melamine resins obtained by Horacek comprise less than 20 triazine nuclei. This statement is supported by the following facts: In order to impregnate the web-like fiber reinforcement the modified melamine resin is applied by dipping or spraying (column 3, lines 28-30 of Horacek). This implies that the melamin resin is at least partly soluble in an aqueous solution in order to be applied appropriately. A person skilled in the art is aware that these properties can only be accomplished by using a melamine resin with a very low number of linked triazine nuclei, especially lower than 20 nuclei.

5. In contrast to Horacek the present invention relates to amino resins comprising mixtures of 20 to 100 triazine nuclei with thermoplastic properties.

The present amino resins are obtainable in a process comprising several steps (see claim 25 and the corresponding description). In a first step a precondensate of C₁-C₈-aldehydes and triazine is etherified with C₁-C₈-alcohols at 25 to 150°C followed by conditioning the triazine derivatives at 150 to 250°C. In a second step the triazine derivatives of the first step are partially re-etherified with diols of type HO-R₄-OH and/or bisepoxides at 60 to 250°C. In a third step the amino triazine ethers obtained in the second step are further condensed to polytriazine ethers at 140 to 220°C. Especially in the third step a polycondensation to aminoplast having more than 20 triazine nuclei occurs.

Furthermore, the high viscosity of the present aminoplasts with values between 300 to 1400 Pas (see Tables on page 47 and 50 of the description) strongly indicates that the triazine nuclei are preferably connected via long bridges stemming from diols and/or bisepoxides introduced in the re-etherification step.

The first and second steps of the process are comparable to the process according Horacek. However, Horacek does not include the third step of further condensing the etherified melamine resin. Thus, it is **not** possible that in a process according to Horacek a melamine resin with high number of triazine nuclei is synthesized. To the contrary, the melamine resin according to Horacek can only exhibit a low number of less than 20 connected triazine nuclei.

A further difference between the present invention and the teaching of Horacek et al. can be seen in the higher degree of etherification and the thermal removal of methylol groups in the resin. This is achieved by applying higher temperatures in the synthesis process.

The following important effects are achieved:

a) A majority of methylol groups is removed especially in the second and third reactions step (see Examples 4 to 15 and 17 to 30 of the present application). A further network forming reaction between the melamine nuclei is thus not any longer possible. This provides for a thermally stable aminoplast and reduces the release of toxic formaldehyde.

b) The C₁-C₈-alcohol of the etherified is replaced by the diol and/or bisepoxide having higher evaporation temperatures (above 60°C) in the second re-etherification step. This allows for the removal of the C₁-C₈-alcohol having lower evaporation temperatures out of the reaction

mixture by distilling. A part of the diol and/or epoxide is incorporated into the resin in a bifunctional manner. This provides for an increase of molecular weight as well as for long flexible bridges between the triazine nuclei. The long flexible bridges cause the unique thermoplastic properties of the present amino resins.

c) Only resins comprising such connected triazine nuclei are processable in the form of a thermoplastic melt. The resins according of Horacek are characterized by a low viscosity and thus do not have thermoplastic properties. In contrast, under the process conditions of the present invention the resin of Horacek would immediately connect to a non-meltable resin.

d) The present resins and the resins of Horacek differ very strongly in their physical properties. The resins of Horacek are liquid at room temperatures, whereas the present resins are solids and storable in form of granules (see for instance Examples 1 to 3 of the present application).

6. I am familiar with the patent US 4,081,426 (Michel et al.)

Michel et al. teaches a process for the preparation of aminoplasts whereby an aminotriazine is reacted with formaldehyde and an C₁-C₄ alkanol at a pressure of at least 0.1 atm and temperatures between 80 to 130°C for 0.2 to 20 minutes. Preferably 0.77 to 3 mol formaldehyde and 2.5 to 7 mol alkanol per amino group of the melamine are used (column 1, lines 57-68). Thus, Michel et al. teaches the synthesis of a melamine-formaldehyde precondensate having a molar ratio of melamine /formaldehyde of 1:2.5 to 1:3.5. Michel et al. does not teach a re-etherification of the thus obtained aminoplast with diols and/or bisepoxides.

Thus, Michel et al. also does not teach an aminoplast comprising 20-1000 triazine nuclei combined through bridging members according to present claim 1.

7. I am of the opinion that by combining the teachings of Horacek and Michel et al. a person skilled in the art also would not arrive at the present invention.

A crucial step in obtaining thermoplastic aminoplasts with 20-1000 triazine nuclei is the condensation of the re-etherified aminotriazines following the re-etherification step. Neither

Horacek nor Michel et al. teach or imply that a further condensation would provide aminoplasts comprising 20-1000 triazine nuclei having increased viscosity and improved flexibility.

On the contrary, Horacek and Michel et al. do not aim to obtain aminoplasts with high viscosity. Such aminoplasts would not be suitable for using as spraying or dipping agents according to Horacek or Michel et al. (see Example 48 – 50 of Michel et al.) since they are simply insoluble in the appropriate solvents and/or not liquid.

Even if a person skilled in the art would combine both teachings he would etherify a precondensate of aminotriazine and formaldehyde having a molar ratio of 1:2.5 to 1:3.5 with a C₁-C₄-alkanol at temperatures between 80 to 130°C (according to Michel et al.) followed by admixing diols to the etherified triazine at 60°C (according to Horacek). Thus, he would solely end up with an aminotriazine resin comprising triazine nuclei less than 20 in which diols are mixed into and not at the present Aminotriazine having thermoplastic properties.

8. I am also familiar with the patent US 3,053,797 (D'Alelio).

D'Alelio teaches polymerizable triazines and polymers thereof. The triazines are characterized by at least one substituent carrying an epoxy group. The epoxy group is preferably attached to the triazine ring via an aromatic hydrocarbon radical by the way of –NH/O/S-divalent aromatic hydrocarbon radical-O/S-Epoxy (column 5, lines 37-46).

The epoxy-substituted triazines can be used for producing thermosetting polymers (column 12, lines 32-36). In general, the epoxy-substituted triazines can be reacted with water or with organic compounds containing one or more active hydrogens, such as alcohols, acids, amines phenols, polyvinyl alcohol or phenol-formaldehyde resin (column 13, lines 25-36). These polymers would be characterized by bridging members comprising –NH/O/S-divalent aromatic hydrocarbon radical-O/S-CH₂-CHOH-CH₂- (column 5, lines 37-49).

In contrast, the present invention relates to polytriazine ethers wherein the triazine segments are combined through bridging members –NH-CHR₂-O-R₄-O-CHR₂-NH- and –NH-CHR₂-NH- (pending claim 22). Thus, there are clearly **structural differences** between bridging

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members according to the present invention and the teaching of D'Alelio and thus between the polymers.

Therefore, a person skilled in the art would not consider the teaching of D'Alelio of bridging members comprising $\text{-NH/O/S-divalent aromatic hydrocarbon radical-O/S-CH}_2\text{-CHOH-CH}_2\text{-}$ in order to arrive at the presently claimed invention, and the teachings of D'Alelio do not cure the insufficiencies of the cited prior art as set forth in the rejection.

9. I declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code, and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

Executed this on Nov. 5th 2008

By:

Ne. Paez

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